REMARKS

Claims 1-36 are pending the above-referenced application. Claims 1-36 are rejected in the current Office Action. The drawings are accepted and the Action is non-final. In particular and according to the item number therein, the Office Action has:

In Item 2, objected to claims 9 and 23 as having informalities that need correction;

In Item 3, rejected claims 1-36 as being indefinite under 35 U.S.C. 112, because, according to the Action, claims 1, 15 and 29 recite the limitation "the viewer space coordinates" without antecedent basis;

In Item 4, rejected claims 1, 2, 4-7, 10-16, 18-21 and 24-36 as being unpatentable over Strunk (U.S. Patent No. 6,137,497) in view of Donham (U.S. Patent No. 6,646,648); and

In Item 5, indicated that claims 3, 8, 9, 17, 22 and 23 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form to include the limitations of the base claim and intervening claims.

Regarding Item 2, Applicants have corrected the typing error that led to the objection.

Regarding Item 3, Applicants have amended the claims to make the antecedent explicit, but points out that the antecedent is present in the phrase "transforming the world space coordinates and the attribute of the vertex to coordinates and an attribute in viewer space...", because the "coordinates...in viewer space" are "viewer space coordinates." Because the antecedent is already present, making it explicit does not change the scope of the claim.

Regarding Item 4, Applicants first note that the independent claims are 1, 15, and 29. Thus, the rejection in Item 4, includes a rejection of the independent claims.

The Office Action has alleged that the combination of Strunk and Donham makes the above claim unpatentable under 35 U.S.C. 103(a). To examine the combination a short description of the relevant sections of each reference is set forth below.

The Strunk reference describes an OpenGL method and an improvement thereto for performing view clipping and model clipping of graphics primitives. Strunk '497 Abstract. The Strunk reference explains "model clipping" as clipping that occurs in eye space (FIG. 1, 110) and "view clipping" as clipping that occurs in clipping space (FIG. 1, 112). Strunk '497, Col. 3, lines

15-18. The OpenGL standard uses two different coordinate spaces, eye space and clipping space, to perform these clipping operations.[1] According to the reference, this requires two distinct clipping processors. The improvement in Struck is to perform the clipping operations in the same coordinate space, homogeneous window space. This space is defined in the reference as a space different from window space 116 shown in FIG. 1. It is also said to be a space that is prior to the perspective divide. Strunk '497, Col. 11, lines 43-46.

The Strunk reference also states that texture mapping subsystem 408 interpolates the received primitive data to compute the screen display pixels that will represent the primitive, and determine its corresponding resulting texture data for each primitive pixel. Strunk, '497, Col. 9, lines 4-13. Regarding the frame buffer system 410, the reference states that it interpolates the primitive data from the front-end subsystem 402 to compute pixels on the display screen that will represent the primitive and to determine object color values and Z values for each pixel. Strunk '497, Col. 9, lines 14-18.

From the description offered in this reference, Applicants have no indication whatsoever as to how the frame buffer subsystem or the texture mapping subsystem interpolate the primitive data, though they appear to be entirely conventional. Strunk, '497, Col. 10, lines 14-16. It is also entirely unclear from this reference as to where in the chain of operations the perspective divide occurs. FIG. 1 of the reference suggests that the perspective divide occurs after the operation of the projection matrix, but the relationship of that matrix to the new homogenous window space is unclear. This confusion is compounded when the specification refers to the use of the MPVD matrix 534 to transform vertex data from homogenous object coordinates 108 to homogeneous window coordinates. Strunk '497, Col. 12, lines 18-24. If the D matrix (the device transformation matrix, Strunk '497, Col. 9, lines 44) is that defined by OpenGL and is part of the MPVD matrix, how can the resulting coordinates still be homogeneous coordinates? At the end of the OpenGL pipeline, the coordinate system is the 2D device coordinate system. It is not possible to be in homogeneous coordinates and the 2D device coordinate system at the same time. Clearly, there is something lacking in the description.

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[1] The reference also describes a deviation from the OpenGL standard in which a model clipping plane is back transformed into object space where model clipping occurs. It is still true that two different spaces are used for clipping.

The Donham reference describes a system and method for evaluating derivatives in screen space using *perspective corrected* barycentric coordinates. Donham '648, Abstract. According to this reference, prior art computations of LOD are inexact, are subject to artifacts, and adversely affect the efficiency of the graphics pipeline. Donham '648, Col. 2, lines 3-9, lines 18-24. The invention described in Donham purports to provide a method for computing the LOD at each point without having to rely on approximations. It computes the exact LOD value and does not require the texture coordinates of adjacent pixels as inputs. Donham '648, Col. 2, lines 43-52. In particular, the reference states that "for any function which can be interpolated in eye space from constants at the vertices of a triangle, the value of f *for a location in the triangle in screen space* can be calculated by interpolating such constants with perspective corrected barycentric coordinates." Donham '648, Col. 6, lines 24-30 (emphasis added). In the reference, FIGs. 3A-3G show the pertinent calculations.

FIG. 3A of Donham shows the calculation barycentric coordinates in screen space, where A, B and C are the coordinates of a triangle in screen space. As is clear from FIG. 3A, the barycentric coordinates are perspective corrected. This means that the barycentric coordinates a, b and c are divided by W (shown at the bottom of FIG. 3A) to arrive at the perspective corrected barycentric coordinates a*, b* and c*.

The Office Action has alleged that it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the techniques of Strunk with those of Donham and that the combination includes all of the elements of Applicants' claims 1, 15 and 29.

Applicants respectfully submit that the combination of Strunk and Donham does not teach all of the elements of Applicants' claims 1, 15 and 29. Claim 1 is set forth below.

> 1. (Currently Amended) A method for obtaining an attribute within a triangle, comprising:
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> obtaining the vertices of a triangle, each vertex being represented by a set of coordinates in a world coordinate space and having an attribute;
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> for each vertex, transforming the world space coordinates and the attribute of the vertex to coordinates and an attribute in viewer space to create viewer space coordinates and a viewer space attribute, said viewer space coordinates being homogeneous coordinates, computing a set of homogeneous coefficients of the vertex based on the viewer space

homogeneous coordinates, said homogeneous coefficients including perspective data, and projecting the viewer space coordinates of the vertex to coordinates in 2D screen space;

determining, in the 2D screen space, pixels that are affected by the triangle based on the 2D screen space coordinates; and

for each pixel affected by the triangle, computing, based on the homogeneous coefficients, a set of barycentric coefficients in viewer space, and performing a linear interpolation based on the set of viewer space barycentric coefficients and the viewer space attributes of the vertices to obtain the attribute of the pixel affected by the triangle.

The combination of Strunk and Donham fails to meet the limitation "computing, based on the homogeneous coefficients, a set of barycentric coefficients in viewer space, and performing a linear interpolation based on the set of viewer space barycentric coefficients and the viewer space attributes of the vertices to obtain the attribute of the pixel affected by the triangle." The combination fails to meet this limitation because Donham performs an interpolation using perspective corrected barycentric coefficients (those having the perspective divide) and Applicants are performing an interpolation with viewer space barycentric coefficients (those prior to the perspective divide). The combination of Strunk and Donham does not change the teaching of Donham, because Strunk provides no guidance whatsoever for how the interpolation is done. In fact, Strunk never even mentions the use of barycentric coefficients.

The Office Action admits that Strunk does not disclose computing barycentric coefficients or performing linear interpolation based on those coefficients to obtain an attribute of a pixel. Office Action, page 4. This causes the Examiner to look to the Donham reference. The Office Action then alleges that the barycentric coordinates of Donham are functionally equivalent to the barycentric coordinates of Applicants' claim. Applicants respectfully point out that there is no such functional equivalence. Applicants' claim recites use of viewer space barycentric coefficients and view space attributes to obtain interpolated attributes of a pixel. The barycentric coordinates of the Donham reference are those in screen space, as the reference clearly indicates in FIG. 3A. The Office Action also alleges that the homogeneous space referred to in Applicants' claims is the same as the screen space in Donham. However, Applicants further point out that no such identification can be made. Homogenous space is a four dimensional space describing a three-dimensional space. Screen space is a two-dimensional space. The two spaces cannot be equated.

Finally, the Office Action has alleged that it would have been obvious to one of ordinary skill in the art to implement the coordinate clipping and transforming techniques of Strunk with the pixel attribute determining techniques of Donham. Applicants respectfully submit that one of skill in the art would not have been motivated to make such a combination. The clipping and transforming techniques of Strunk all occur prior to the perspective divide. Strunk '497, Col. 11, lines 42-46. The pixel attribute determining techniques of Donham occur after the perspective divide. One of skill in the art having Strunk would not have looked to Donham's teachings as they are outside any teaching or suggestion of Strunk. Strunk offers no reason or motivation to look to the techniques of Donham to perform interpolations, because, from the teachings of Strunk, they are taken care of by the texture mapping subsystem or the frame buffer subsystem (i.e., there is no common problem being solved). Certainly, the failure of Strunk to mention anything about barycentric coordinates gives no reason for one of skill in the art to seek out the teachings of Donham. Therefore, Applicants fail to see the specific teaching or suggestion[2] in Strunk that is needed to combine with it the teachings of Donham. Additionally, it is difficult to discern any desirability of making the combination, as Strunk fails to set forth any need for the use of barycentric coordinates to perform interpolation.

The Office Action has alleged that a motive to combine might be found in enhancing the graphics computer system by not requiring texture data of adjacent, not in view, pixels to be calculated more efficiently. Applicants respectfully submit that if the invention in Strunk works for its intended purpose, it would be assumed that calculations by the texture mapping system would be for pixels after the results of clipping. Therefore, it appears there texture calculations would occur for primitives that were in the viewport. However, Applicants fail to see how this suggests that the teachings of Donham would have been combined with those of Strunk. The proposed motivation only applies to the possible results of Strunk and is in no way connected with the teachings of Donham, which seeks a more accurate way of computing LOD data by not using adjacent texture data.

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[2] *Brown & Williamson Tobacco Corp. v. Philip Morris Inc.*, 229 F.3d 1120, 56 USPQ2d 1456 (Fed. Cir. 2000). The showing of a motivation to combine must be clear and particular and it must be supported by actual evidence.

Therefore, Applicants conclude that the combination of Strunk and Donham fails to teach the limitations of Applicants' claims 1, 15 and 29, and further that the combination of Struck and Donham would not have been made in any event as there is no particular teaching or suggestion in the record to make such a combination.

Regarding claims 2 and 16, Applicants submit that these claims are allowable at least because the claims from which they depend, 1 and 15, are allowable. The Office Action has alleged that 1/WA and a* are equivalent to the parameters X1h, Y1h, Z1h, W1 of Applicants' claims. Applicants respectfully disagree. The parameters X1h, Y1h, Z1h, W1 are homogeneous coordinates in eye space and the 1/WA and a* in the Donham reference are parameters in screen space, not eye space. Donham specifically states that all of the formulas in FIG. 3A are in screen space. Therefore, Applicants believe that claims 2 and 16 are allowable.

Regarding claim 4 and 18, Applicants submit that these claims are allowable at least because the claims from which they depend, 1 and 15, are allowable.

Regarding claims 5 and 19, Applicants submit that these claims are allowable at least because the claims from which they depend, 1 and 15, are allowable. Additionally, the combination does not teach or suggest the limitation "wherein determining the pixels affected by the triangle includes providing blank pixel data associated with the affected pixels." There is no teaching or suggestion in the combination regarding blank pixel data.

Regarding claims 6 and 20, Applicants submit that these claims are allowable at least because the claims from which they depend, 5 and 19, are allowable. Additionally, the combination does not teach or suggest the limitation "wherein for N pixels affected by the triangle the blank pixel data includes N screen space coordinates $\{[X_1s, Y_1s], [X_2s, Y_2s] \ldots [X_Ns, Y_Ns]\}$, because the Strunk reference does not inherently disclose blank pixel data in screen space. According to case law, inherency in a teaching means that the inherent subject matter must necessarily follow from the disclosed subject matter and that one of skill in the art would have so recognized. Here, it is not clear how rasterization occurs in the teachings of Strunk. Just because screen coordinates are being used, does not necessarily lead to the conclusion that the pixel coverage of a graphics primitive such as a triangle, includes having blank pixel data. Many techniques are available for rasterizing or scan-converting an image. Not

all of the techniques involve identifying blank pixel data of a graphics primitive. Therefore, Applicants conclude that Strunk does not teach the limitations of claims 6 and 20.

Regarding claims 7 and 21, Applicants submit that these claims are allowable at least because the claims from which they depend, 4 and 18, are allowable. Additionally, the combination fails to disclose the limitation "wherein the rasterization provides blank pixel data associated with the pixels affected by the triangle," for the reasons set forth regarding claims 5 and 19, and 6 and 20.

Regarding claims 10 an 24, Applicants submit that these claims are allowable at least because the claims from which they depend, 1 and 15, are allowable. Additionally, Applicants submit that the combination fails to teach the limitation "wherein the depth and perspective data of each of the pixels affected by the triangle is represented by parameters in the homogeneous space." The Office Action has alleged that Strunk teaches the above limitation. However, Strunk is not referring to the rendering process by which it is determined which pixels are affected. Strunk, in the cited portions, is referring to vertex data. Strunk must still rely on some rasterization process to determine the value of pixels within visible portions of graphics primitives to be rendered. Strunk specifically states that the interpolation process is performed by a conventional texture mapping subsystem and a conventional frame buffer subsystem about which Strunk is all but silent. The transformation matrix MPVD, as far as can be determined from the reference, operates on vertex data only. Strunk, '497 Col. 12, lines 20-24.[3]

Regarding claims 11-14, 25-28, and 36, the Office Action has alleged that neither Strunk nor Donham explicitly discloses the attribute value specifically being depth or shading values as recited in claims 11/25, 14/28 and 36. Applicants respectfully submit that claims 11-14, 25-28 and 36 are allowable because the claims from which they depend, 1, 15, and 29 are allowable.

Regarding claim 30, Applicants submit that these claims are allowable at least because the claim 29 from which it depends is allowable. Additionally, the Strunk reference states nothing about the specific implementation of the graphics accelerator. Furthermore, fixed and

[3] Specifically, Strunk states that the MPVD matrix multiplies the vertex data. It is hard to see how interpolated screen data can come from multiplying vertex data by a matrix. Matrix multiplications of vertex data only return new vertices.

floating point conversions do not necessarily imply the use of a reciprocal unit. Therefore, Applicants submit that claim 30 is allowable.

Regarding claim 31, Applicants submit that this claim is allowable at least because the claim from which it depends 29, is allowable. Additionally, Applicants submit that the combination of Strunk and Donham has no teaching or suggestion that an SIMD scalar unit is applicable here.

Regarding claim 32, Applicants submit that this claim is allowable at least because the claim from which it depends 29, is allowable. Additionally, the combination does not teach or suggest the use of "two-ALUs configured to operate with shifted processing cycles, using the bypass registers, to interleave triangle and pixel processing instructions."

Regarding claim 33, Applicants submit that this claim is allowable at least because the claim from which it depends 29, is allowable.

Regarding claim 34, Applicants submit that this claim is allowable at least because the claim from which it depends 29, is allowable.

Regarding claim 35, Applicants submit that this claim is allowable at least because the claim from which it depends 29, is allowable.

Regarding Item 5, the Office Action has indicated that claims 3, 8, 9, 17, 22 and 23 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form to include the limitations of the base claim and intervening claims. Applicants have submitted new claims 37-42. Claim 37 corresponds to rewritten claim 3, claim 38 to rewritten claim 8, claim 39 to rewritten claim 9, claim 40 to rewritten claim 17, claim 41 to rewritten claim 22, and claim 42 to rewritten claim 23. As such, Applicants believe that these claims are in allowable form.

Thus, having responded to each and every ground of rejection and objection, Applicants respectfully request reconsideration and allowance of the pending claims and the new claims in the above-mentioned application.

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Date: August 1, 2005

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